Sahara Benton

Time- 60 minutes

Grade 5

Subject- Math- integrating STEAM-sustainability

Midterm Lesson Plan

Background- When a room feels too cold or hot, your first response might be to adjust the thermostat, but an engineer may question whether the building has been properly insulated to avoid energy waste and high utility bills. In this lesson, students assume the role of building engineers, testing several materials to determine which would provide the best house insulation. They learn about the role of insulation in preventing heat transfer and discuss the importance of energy conservation in buildings. Students will use mathematical practices and skills to display the data using a line graph.

**Learning Objectives**

After this activity, students should be able to:

* Describe how insulation works.
* Demonstrate how some materials insulate better than others
* Relate that effective insulation helps conserve energy.
* Describe how energy engineers use insulation when designing products.
* Display data using a line graph to show a change over time.

**Vocabulary**

*Energy conservation:* The wise and efficient use of energy resources, resulting in reduced energy usage.

*Insulation*: A non-conductive material or substance used to prevent the transfer of heat, electricity, or sound.

*Scientific method steps:* 1) Form a hypothesis, 2) Make predictions for that hypothesis, 3) Test the predictions, and 4) Reject or revise the hypothesis based on the research findings.

**Other keywords:** energy, energy savings, heat loss, nonrenewable, renewable, scientific method, temperature, thermometer

**Engage-** The heating and cooling of buildings uses a lot of energy, so engineers continually look for creative ways to reduce the heating and cooling demands, and thus the total amount of energy required. One way to do this is by using insulation. Today, engineers have developed many types of insulation such as fiber glass, rock wool, mineral wool, natural wool, cotton, straw, cellulose, paper, polyurethane foam, polystyrene foam, polyester and soy foam. Some insulating materials are suitable for sound proofing, too. This learning will be supported with a brain pop video- heat

**Educational Standards**

**NBT 7- add and subtract decimals**

**Explore-** Conserving energy means using energy wisely and efficiently, but there are many ways we waste energy by not using it wisely. Buildings often waste great amounts of energy, with most of the energy use being put to heating or cooling the building. One way engineers reduce the amount of energy required to heat or cool a building is by using good insulation.

*Insulation* is a material or substance used to prevent the transfer of heat, electricity or sound. In a building, insulation is placed in the walls and roof. When insulating a building, the quality of an insulation material is measured by how well it keeps heat out. Typically, heat flows from warm areas to cool areas. When you touch something cold, heat is actually leaves your body to try and warm the cool surface, creating a balance of energy. Insulation helps to prevent that transfer of heat.

There are many different materials used for insulation. Engineers often use fiber glass, wool, cotton, paper (wood cellulose), straw and various types of foams to insulate buildings. A layer of trapped air can serve as insulation, too! Some insulating materials are suitable for sound proofing, as well.

**Explain- Procedure- Safety:** Remind students that glass thermometers are breakable and work with caution when handling the heated water.

**Scaffold- digital thermometers available**

**With the Students**

1. Introduce the activity by providing students with information about building energy use and insulation. Explain that the class will conduct an engineering investigation to determine the type of material that would best insulate a house — wool, newspaper, aluminum foil, or a plastic bag. Review the steps of a scientific investigation using the vocabulary section above. Remind students that engineers need to understand energy conservation concepts to design more effective home energy systems.

2. Divide the class into groups of 4-5

3. On the board- *Which type of insulation would keep my house warmest in the winter?*

4. Show students the four insulation materials to be tested — wool, newspaper, aluminum foil, and plastic bags. Ask them to hypothesize which they think will be the best insulating material. Have them circle their predictions on their worksheets.

5. Have group members determine ahead of time who will be responsible for which tasks.

**Elaborate-** Once students have assigned accountable tasks

1. Wrap the four plastic bottles with equal amounts of each material to serve as insulators.

2. Pour equal amounts of hot tap water into each bottle.

3. Immediately after the hot water is poured in the bottle, measure its temperature. Record these beginning temperatures on the worksheets.

4. Have students pause for 15 minutes to draw the diagram of their set-up on their worksheets.

5. After 15 minutes, direct students to measure and record the current temperature of the water in each bottle.

6. Next, to calculate the change in temperature for each bottle, students should subtract the ending temperature from the beginning temperature.

7. Which material was the best insulator based on the student data? Which had the smallest change of temperature? What material(s) would the students recommend? If groups reached different conclusions, take a poll to find out which materials worked best overall. As a class, agree on a concluding statement for the experiment based on everyone’s research findings. Solicit suggestions from students as to other materials they could use, ways to extend or refine the test, and other possible insulation tests they could conduct.

**Evaluate- Assessment**

**Pre-Activity Assessment**

*Drawing:* Have the students draw pictures of a typical summer clothing outfit and a typical winter clothing outfit. As a class, discuss the differences and why.

*Discussion:* How do clothes serve as insulation for the human body? Ask the students what type of clothes they wear in the summer and what they wear in the winter? What is the difference between the clothing? Possible answers: *Summer clothes allow the heat created by our bodies to dissipate into the surrounding air. Winter clothes, such as heavy winter jackets, sweaters, mittens and hats, trap our body’s heat to keep us warm.*

**Activity Embedded Assessment**

*Worksheet:* Have the student teams complete the table. Review their answers to gauge their mastery of the concepts.

Math Extension- Students will display this data using a line graph to show the change in temperature over time.

**Post-Activity Assessment**

*Discussion:* Which material provides the best insulation? Which would you wear to keep warm in the winter? We all use too much energy. If we were to reduce the amount of energy we use each day, then we would cause less pollution of the environment and our fossil fuels would last longer. Engineers find many ways to conserve energy in our homes, schools and offices. If we built houses with better insulation, less heat would escape through the walls, roof and windows. Light bulbs with lower energy demand also help conserve energy.

*Insulation Application:* Insulation prevents the transfer of heat, electricity or sound. Have students design a different product using insulation. How many things can they think of that would use the idea of insulation? Examples include a swimming pool, a house in an extreme environment, clothing, ear plugs, a coffee mug, an electric plug or an auditorium.

Name\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_   Date\_\_\_\_\_\_\_\_\_\_

Grade 5 Science Rubric

Conserving Heat

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Component | 3 | 2 | 1 | Score |
| ASK  the question | The question makes sense and can be answered through experimentation.  Variables are used in the question. | The question makes sense and can be answered through experimentation.  Some variables are used in the question. | The question does not make sense OR can not be answered through experimentation.  No variables used in the question. |  |
| CONDUCT  the experiment | Step-by-step **procedures** were followed, logical and clearly written.  Specific list of **materials** is included. | Step-by-step **procedures** were followed.  Some improvements were needed to develop the project.  A list of **materials** is included. | **Procedures** were unclear and not listed step-by-step.  Little or no **materials** listed. |  |
|  |
| ANALYZE  the results | **Data table** and **graph** are accurately labeled, drawn, and information is correct. | **Data table** and **graph** are somewhat accurately labeled, drawn. There may be information missing. | **Data table** and **graph** contain errors in labels, drawing and/or information. |  |
|  |
| CONCLUDE | Results and Conclusions show a clear and accurate understanding of knowledge gained from conducting the experiment. The paragraphs show thought and effort. | Results and Conclusions show somewhat of a clear and accurate understanding of knowledge gained from conducting the experiment. The paragraphs show some thought and effort. | Results and Conclusions are unclear and show an inaccurate understanding of knowledge gained from conducting the experiment. The paragraphs show little thought and effort. |  |
| COMMUNICATE  the results | The **data**  is complete, neatly written or typed, and shows effort and creativity.  Pictures are displayed.   **Presentation** was well planned and organized.  Everyone spoke clearly and had a part. | The **data**  is mostly complete, neatly written or typed, and shows some effort and creativity.  **Presentation** was well organized and planned for the most part. Everyone spoke clearly and had a part. | The **data**  is incomplete, sloppy, and shows little effort and creativity.  **Presentation** was disorganized and planned poorly. |  |
|  |
| Spelling, Grammar, Punctuation, Capitalization | All mechanics are correct. | There are few mechanical errors. | There are many mechanical errors. |  |
| Group Work | Group members were on task at all times working cooperatively on the project as a team. | Group members were on task most of the time, working cooperatively on the project as a team. | Group members were not on task at all times and did not work as a team. |  |